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BEFORE THE  
FEDERAL COMMUNICATIONS COMMISSION  
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OFFICE OF THE SECRETARY

ORIGINAL  
FILE

IN THE MATTER OF )

AMENDMENT OF THE COMMISSION'S )  
RULES TO ESTABLISH NEW )  
PERSONAL COMMUNICATIONS SERVICES )

GEN. DOCKET No. 90-314  
ET DOCKET No. 92-100

TO: THE COMMISSION

COMMENTS OF  
CORPORATE TECHNOLOGY PARTNERS  
TO THE NOTICE OF PROPOSED RULE MAKING  
AND TENTATIVE DECISION

CORPORATE TECHNOLOGY PARTNERS

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## **SUMMARY**

Corporate Technology Partners ("CTP") is the co-developer with Bell Northern Research ("BNR") of the first fully detailed technology approach for frequency sharing with fixed microwave transmissions. This approach called PCI (Personal Communications Integrator) was invented in June 1990, well before the APC FAST approach, and its components are integral to CT2 Plus, the PCS system chosen for Canada. For the U.S. market at 1850-1975 MHz, CTP adapted PCI for use with narrow channel CDMA and has called its approach Interference Sensing CDMA ("ISCDMA"). ISCDMA has advantages in capacity, cost and certainty of protection for fixed microwave users over all alternative PCS technologies.

CTP is concerned that a number of the Commission's proposals in the NPRM, if adopted, would either directly benefit other technology approaches over the ISCDMA approach or at least fail to utilize the full capabilities of ISCDMA. Examples are the proposed relaxation of TSB10-E, the allocation of specific frequency blocks within the 1850-1975 MHz band, the rejection of PCS for fixed site services and the setting of specific negotiation rules for moving fixed microwave users to other frequencies. ISCDMA allows all operators to share all frequencies in the 1850-1975 MHz band without need to set aside specific frequency blocks. With ISCDMA relative market success of operators in gaining subscribers will determine relative allocation of frequency. ISCDMA has such substantial capacity in frequency sharing with fixed microwave transmissions that it can be used to compete with LEC fixed site services (local loop) as well as to compete with cellular radio; and employing ISCDMA there will be so little need to relocate fixed microwave users that it is inappropriate to set specific negotiation rules. Further, despite discussion in the NPRM about international coordination, the Commission's proposed rules make no allowance for PCI despite the fact that PCI would allow PCS roaming in the 900 MHz band between the U.S. and Canada.

ISCDMA fully meets the most stringent of technical alternatives proposed by the Commission in the NPRM, including TSB10-E. Also, ISCDMA allows dynamic sharing of all assigned frequency among all operators without the need to assign specific blocks of frequency. There are obvious advantages in such open assignment of frequency including avoidance of situations where one operator's frequency block in a given geography is more negatively impacted by fixed microwave transmissions (i.e., has less usable capacity) than is the assigned block of a competing operator.

Regarding licensing and regulation, CTP's principal concern is that the PCS rules must continue to provide inducement for on-going development work by the PCS entrepreneurs which have invented important PCS technologies and services. The prospect of a wide open lottery or auction with no recognition to be given for prior PCS

work would seriously discourage CTP from completing development of a technology, ISCDMA, which appears to be the best frequency sharing technology in the world for PCS, and one that is readily exportable.

On other licensing and regulatory matters CTP believes:

- Assignment of licenses by LATAs would give maximum benefit to the subscriber.
- No national license should be given to a single company. Rather, to secure the benefits of a national, seamless PCS network, in band interoperability and roaming capability should be encouraged across the U.S. and recognition should be given to national network coalitions of PCS operators such as the one CTP is building to accomplish this objective.
- If full PCS CAI interoperability among license holders is required, four or five licenses per LATA could be issued; but if interoperability is not required, at most three licenses should be awarded with perhaps even fewer in rural LATAs.
- No separate frequency allocation should be made for unlicensed use (i.e., an unlicensed PCS band). Providing for an unlicensed band will discourage coordination between public licensed operation, data transmission and wireless office PBXes/Centrexes resulting in higher cost and lower utility for subscribers.
- No specific rules should be set regarding negotiation for relocation of fixed microwave users. ISCDMA does not require such relocation, at least in the near term, and in any case it is best to allow market forces to govern any necessary relocation.
- Lotteries with strict pre-qualification requirements, build-out requirements (before license sale) and the fees proposed by the Commission should be the licensing approach adopted by the Commission. PCS developers such as CTP should be automatically pre-qualified.
- The auction alternative is less favorable because auction costs would have to be passed on to subscribers. Also, auctions will impact negatively the opportunities of smaller, entrepreneurial companies. If auctions are used, the top two bids in each market should be thrown out to prevent overbidding, national simultaneous sealed bids should be used for all markets, and PCS developers should be given a special position in the auctions.

- If the Commission chooses to divide the 1850-1975 MHz PCS frequency into channel blocks, the Commission should consider reserving one block for PCS developers such as CTP as a way to encourage continued development of the PCS technologies and services of the future.
- No economies of scope exist in PCS, and, accordingly, economy of scope should not be used as a reason to allow cellular operators and LECs to provide PCS in their operating territories. Because they will not want to strand their embedded base, LECs have reason not to market PCS strongly to all potential customers. They will not use the scarce PCS spectrum well in their operating territories. Because of this and potential failure of LECs to provide equal access, LECs should be circumscribed in providing PCS in their operating territories. Cellular radio operators should be precluded.
- To best meet the Commission goals of universality and competitive diversity, PCS should be classed as common carriage and the PCS operator allowed to resell both local and long distance services.
- The Commission's proposals on interconnection and relative FCC and PUC regulatory rights should in general be adopted, but rates for LEC access should be set considerably below those now paid for cellular access and interconnection should be defined in detail.

Technologies such as APC's FAST approach are but half way points to the more advanced technologies of the future, of which ISCDMA is an example. The Commission should ensure its rules allow the full capabilities of those more advanced future technologies to be realized. The capabilities of ISCDMA and other technologies we may see in the future include greater capacity and more security in frequency sharing with fixed microwave transmissions; and while these technologies allow implementation of the strictest technical rules for protection of fixed microwave users, at the same time they allow relaxation of rules regarding such things as relocation of fixed microwave users and specific allocation of channel blocks. Because of these capabilities, the licensing process should provide continued encouragement to the leading PCS developers that their work will lead to a "leg up" on gaining an operating license.

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**1. GENERAL COMMENTS - THE COMMISSION IN BALANCING ITS PCS GOALS OF UNIVERSALITY, SPEED OF DEPLOYMENT, DIVERSITY OF SERVICE AND COMPETITIVE DELIVERY SHOULD BE CAREFUL NOT TO FAVOR ANY PCS TECHNOLOGY OR PCS APPROACH.**

Corporate Technology Partners ("CTP") is, we believe, the first entrepreneurial company in the U.S. to be engaged in PCS development. A chronological history of CTP's contribution to PCS development is attached as Exhibit A. Specifically, it is important for the Commission to know that:

- It was CTP, not American Personal Communications ("APC"), that was the first to develop a detailed, practical approach to narrow channel frequency sharing with fixed microwave. This is demonstrated by the CTP/Bell Northern Research ("BNR") patent application of October 1990 and numerous filings by CTP and Northern Telecom with the Commission both before and after that date.<sup>1</sup> The approach developed by CTP with BNR was and is a complete, highly detailed, eminently workable system. It was developed in June 1990, prior to the FAST system, and is basic to the CT2

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<sup>1</sup>See the exhibits attached to CTP's Pioneer's Preference Request, File No. PP-51.



Plus PCS system now chosen as a national PCS system for Canada. The technology is called Personal Communications Integrator ("PCI").

- CTP was the first to develop an approach which through interference sensing at base station and handset dynamically adjusts the PCS system to fixed microwave interference. This approach, which again is now inherent in the CT2 Plus PCS system for Canada, is a distinct advance over exclusion zone based approaches, such as the FAST system of APC. Advantages include higher capacity in co-existence with fixed microwave transmissions, certainty of protection for fixed microwave users and both technological and regulatory simplicity.
- CTP, not APC or any other PCS participant, was the first to describe and promote widely the advantages of narrow channel technology in frequency sharing with fixed microwave. Rather than keep its innovation a secret, CTP, BNR and Northern Telecom brought the advantages of narrow channel frequency sharing to industry attention in every possible way and at every possible opportunity, promoting enthusiastically the development of narrow channel technologies as the best approach to PCS frequency sharing with fixed microwave transmission. For example, all PCS experimental license holders were contacted in the Fall of 1990 and were sent technical documents on narrow channel frequency sharing with fixed microwave. Now all but a few companies which are pursuing PCS are espousing narrow channel technology; and it is doubtful that any company currently espousing narrow channel approaches to PCS failed to gain from the early CTP/BNR research showing a practical approach to narrow channel frequency sharing with fixed microwave.
- CTP, not any of the current CDMA manufacturers, was the first to develop and to disseminate a specific, detailed workable approach for frequency sharing of narrow channel CDMA with fixed microwave transmissions. This approach, which CTP calls Interference Sensing CDMA ("ISCDMA"), is entirely the innovation of CTP. No outside consultants were used to develop the approach. Attached as Exhibits B and C are the technical papers filed as part of CTP's Pioneer's Preference Request (PP-51) and under CTP's PCS Experimental License which describe the technology. ISCDMA is the first second generation technology for frequency sharing with fixed microwave and offers important advances over first generation frequency sharing technologies such as APC's FAST approach. ISCDMA is simpler, less costly and more elegant than the APC FAST approach. Unlike the APC FAST approach, it has significant export potential. It is the ISCDMA technology of the future.

Throughout its history of firsts in PCS (and the list could be made much longer), CTP has been pursuing the goals now announced by the FCC as its goals - Universality, Speed of Deployment, Diversity of Service and Competitive Delivery. The technical approach CTP has developed, and regulatory, licensing and other solutions resulting from this technical approach, was designed to meet the four goals of the Commission and meets these goals better than any PCS alternatives. CTP's technology, ISCDMA, allows the greatest universality of service with "highest quality at low-cost, and reasonable rates to the greatest number of consumers, consistent with the Communications Act."<sup>2</sup> This is because ISCDMA operates with higher capacity and lower cost in frequency sharing with fixed microwave than alternative technologies. Speed of deployment is such that for one application of the technology, deployment could occur first half 1993, and for other applications end 1993. The CTP technology provides for diversity of service and of service providers better than any other PCS approach of which CTP is aware. As explained below, ISCDMA's higher capacity and ability to share all allocated frequency among all operators allows a greater number of licenses to be granted and more flexibility in their use. Finally, the CTP approach offers greater flexibility of competitive delivery.

Each of these advantages will be made clear in following sections wherein CTP addresses specific questions raised by the Commission in the NPRM. However, CTP has a strong initial concern on reading the NPRM. It appears from the questions asked by the Commission in the NPRM, and in some cases by the solutions proposed, that the Commission has not fully considered the capability of the interference sensing technology CTP has proposed, and is largely thinking in terms of exclusion zone approaches, such as the APC FAST system. Similarly, it appears in the 900 MHz band the Commission has not considered the advantages of the Personal Communications Integrator ("PCI") technology developed by CTP and BNR and proposed to the Commission as early as September 1990.

By way of example:

- In the technical standards section of the NPRM (p. 41 et seq.) the Commission in several instances seems to entertain possible relaxation of standards set under Bulletin TSB10-E. As CTP understands it, APC seeks this relaxation for operation of its FAST system. CTP, on the other hand, has specifically designed its system to the TSB10-E rules. ISCDMA perhaps uniquely, has the capability to provide assured protection of microwave users in complete compliance with TSB10-E while offering high capacity, low cost service. Thus relaxation of the standards set under Bulletin TSB10-E would benefit systems that have trouble meeting these

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<sup>2</sup>Page 4 of the NPRM.

standards while failing to take advantage of the full capabilities of ISCDMA.

- Specific blocks of channels with 20, 30 or 40 MHz allocation are proposed (p. 16 of NPRM). Specific channel block allocation is appropriate for the APC FAST system. However, it is unnecessary for ISCDMA. The interference sensing capabilities of ISCDMA allow multiple operators to share the same spectrum - truly letting the market decide between the competing operators as to which operator has what use of the scarce spectrum.<sup>3</sup> This directly supports two of the four goals of the Commission, providing possibility of greater diversity of service and greater competition in delivery. Setting specific blocks defers to technologies which need specific block allocation; whereas a better approach would be to allow licensees to negotiate among themselves frequency blocks as needed depending on technology choice.
- On page 19 et seq. of the NPRM the Commission proposes specific rules for negotiation of the relocation of fixed microwave users. The APC FAST approach and similar exclusion zone approaches need relocation to gain necessary PCS capacity. As explained below, because of its unduplicated capacity in frequency sharing with fixed microwave transmissions, ISCDMA does not require relocation, at least in the near term. Accordingly, relocation negotiation requirements appear to CTP to be set up primarily to benefit APC and exclusion zone approaches. In a sense they take APC and other exclusion zone proponents "off the hook" for the failure of their technology to have the frequency sharing capability of ISCDMA. To avoid favoring particular technologies, the Commission should not set specific relocation negotiation rules but should allow negotiation to occur as needed and as determined by market demand and technology selection.
- On page 14 of the NPRM the Commission appears to reject use of PCS for fixed services except on an ancillary basis. In filings with the Commission CTP has demonstrated use of ISCDMA, interfacing to copper, fiber or COAX, for use as wireless local loop.<sup>4</sup> The capacity of ISCDMA is such

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<sup>3</sup>As discussed below, this is a fairer approach than exclusion zone approaches such as FAST as one operator's block of allocated frequency may encompass more fixed microwave interference, and hence have more unusable channels, than a competitor's allocated frequency block.

<sup>4</sup>See CTP's various comments and reply comments in its pioneer's preference application (PP-51) and CTP's Reply Comments in ET Docket No. 92-100.

in frequency sharing with fixed microwave that it can support competition not only with cellular radio but also with LEC local loops. Alternative PCS systems lack this capacity. Accordingly, in restricting fixed site use, the Commission again may be deferring to inadequacies of systems other than ISCDMA.

- Regarding 900 MHz services (p. 21 et seq.) no recognition is given to PCI which is a technology that would allow the Commission to have cross-border PCS roaming with Canada. PCI was the first fully developed narrow channel frequency sharing technology ever introduced to the Commission (in September 1990). As noted above, its capability was backed by BNR and Northern Telecom with full technical papers filed with the Commission. PCI allows the Commission to follow its stated goal of international cooperation. What is required to allow PCI to be implemented is allocation of part of the 930-931 MHz and 940-941 MHz spectrum to PCI for control channels, and then to allow frequency sharing with fixed microwave transmissions on a non-interfering secondary user basis in the 930-960 MHz frequency band. The advantages of PCI and its importance in allowing cross border roaming with Canada in PCS were set out in documents filed with the FCC (see CTP and Northern Telecom documents attached as Exhibits D, E, and F).

CTP is a small company, located in the San Francisco Bay area. As such it lacks the Washington D.C. presence of certain other PCS companies. Nonetheless, it has an enviable record of firsts, perhaps more than any other company engaged in PCS. As such CTP and its PCI and ISCDMA technologies should not be ignored. This technology, or some adaptation of it, will come to be widely adopted as the technology of choice across North America for PCS. Its advantages, as outlined in Exhibits B through F, are too great to disregard when compared to exclusion zone approaches such as the FAST system.

At the very least, we submit, the Commission should make room for PCI and ISCDMA. Strict adherence to Bulletin TSB10-E and all other protections proposed by the Commission should be required to totally secure fixed microwave users from PCS interference. No specific channel blocks should be set aside in allocated PCS licensed bands but technology choice and usage allowed to adjust the allocation. PCS should be allowed for wireless local loop transmission to receivers affixed on outside walls at home and office, as well as for mobile use. Portions of the 930-931 MHz and 940-941 MHz bands should be allocated for PCI (CT2 Plus) and secondary usage allowed with fixed microwave at 930-960 MHz to provide roaming with Canada.

The Commission has repeatedly stated it intends to be technology neutral in its PCS rule making. CTP respectfully suggests that the majority of commentators are

adherents to exclusion zone approaches, such as APC's FAST system, and that the minority, and we believe better technology of CTP should be given equal room to grow to its full serving capability.

**2. TECHNOLOGY ISSUES - CTP'S TECHNOLOGY MEETS ALL OF THE TECHNICAL CRITERIA PROPOSED IN THE NPRM, AND THESE SUGGESTED TECHNICAL CRITERIA ARE APPROPRIATE.**

CTP will turn first to technology questions raised in the NPRM as it believes answers to these questions to some extent determine answers to other questions raised in the NPRM.

**A. TSB10-E Should Be Applied And Computation Should Include Number Of PCS Transmitters Likely To Be In Simultaneous Operation.**

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This is the first technical question asked in the NPRM. Exhibit C sets out in detail the formulae and approaches needed to ensure compliance with TSB10-E. ISCDMA technology was specifically designed for compliance with TSB10-E. As explained in Exhibit C, interference to fixed microwave within the FCC suggested coordination distances is measured at base station and subscriber terminal on each call. The algorithms that need to be set are based on simple measurement of: (a) Interference power from the microwave transmitter(s) to the base station(s); (b) Transmitter power of the microwave station(s); (c) Operating bandwidth of the microwave transmitter(s) and number (or like number) of PCS transmitters in use (e.g., see p. 7 of attached Exhibit C.) These same formulae and algorithms apply to PCI for the determination of interference at handset and base station in a PCI system (as set out in Exhibits D, E, and F).

The technical approach outlined in Exhibits B and C is an elegant, simple solution to the frequency sharing problem. Not only does it fully meet the Commission's Part 94 rules and TSB10-E, but it provides added capacity and lower cost versus alternative approaches to frequency sharing with fixed microwave. A patent was applied for on PCI. Now a patent is being applied for on PCI as outlined in Exhibit C. Under its patents CTP intends to openly license its approach to the PCS industry.

**B. The Commission's Suggested Straight Power Addition Approach To Determine Interference To Microwave Receivers Is Appropriate.**

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CTP's calculations and the formulas set out in Exhibit C are based upon the potential interference to microwave receivers created by the summed power of

the PCS system transmissions. This provides secure protection to the fixed microwave transmission user, and we can find no reason to relax this standard and increase interference risk.

**C. Power And Antenna Height Restrictions Proposed By The Commission Should Be Adopted.**

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ISCDMA technology operates with average subscriber terminal power of 10 milliwatts and base station power well under the 10 watts proposed on page 45 of the NPRM. Further, the 91 meter antenna height suggestion is more than adequate for ISCDMA. Regarding a related question (p. 46 NPRM), power and height limits need not be those of cellular.

**D. Coordination Distances Proposed By The Commission Are Appropriate.**

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CTP has designed its technology to comply with the coordination distances listed on pages 46 and 47 of the NPRM (see Exhibit C).

**E. The Commission Should Consider Alternatives To The Proposed 2 GHz PCS-to-PCS Interference Standards.**

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As noted in CTP's General Comments above, the Commission has chosen to propose 20, 30 or 40 MHz bands for PCS licensees (p. 16 NPRM). In the technical standards (p. 47 of the NPRM) it is then proposed to employ a 39 dBu signal level standard to prevent co-channel and adjacent channel interference between PCS operators on their assigned bands. This approach has two problems:

- In areas of dense use of fixed microwave transmission in the 1850-1975 MHz band, one 20, 30 or 40 MHz frequency block will often be favored over another with regard to number of usable channels in the frequency block. Using, for example, the FAST system approach, we might find in Los Angeles that in one part of the City (or, indeed, large parts of the City) one operator has more excluded channels in its "exclusion zone" than does the other operator. Clearly this does not meet the Commission's goal of open and fair competitive delivery.
- With specific channel blocks allocated to three to five operators, some of the blocks may be fully used in given areas while a neighboring block is under-utilized because the operator has been less successful in the market. We are reminded in this connection of the CT2 experience in the U.K. where only one operator is now going forward. For maximum flexibility in diversity of services and competitive delivery, the ideal would be for the

operator which has fully used its available channels in an area to be able to access unused channels in a neighboring license block.

What ISCDMA allows is an answer to both these problems by allowing complete sharing of all licensed PCS frequency by all operators. Three, five or even more operators could operate on the same frequency. The ISCDMA technology described in Exhibits B and C would then automatically adjust frequency allocation among the operators in accordance with relative subscriber demand. No operator would be disadvantaged by having assigned to it a frequency block containing more microwave interference than a competitor's frequency block. No frequency blocks would be wasted because the particular operator for that frequency block failed to aggressively pursue its PCS business. ISCDMA thus allows the market to truly take charge of the relative frequency allocation.

As CTP believes specific frequency blocks should not be designated, it also believes it is unnecessary to establish PCS-to-PCS interference standards. Everything should instead be left to negotiation among the license holders for the specific geography.<sup>5</sup> If they all chose ISCDMA, then no set aside of particular frequency blocks for particular operators would be indicated. If some chose another technology, the negotiation might provide for at least some frequency blocks. However, the standards for PCS-to-PCS interference might in the negotiation come to be different from 39 dBu through use of ISCDMA for some of the licenses. ISCDMA could co-exist with other technologies with far lower PCS-to-PCS interference protection than that proposed by the Commission. In short, CTP feels that setting specific frequency blocks and PCS-to-PCS interference standards prevents employment of important attributes of ISCDMA technology. The Commission should do nothing more than make a general assignment of the licensed frequency (i.e., 1850-1975 MHz), then select the group of licensed operators and let these operators sort out frequency allocation and PCS-to-PCS interference issues among themselves.

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<sup>5</sup>Negotiation is proposed by the Commission to deal with migration of fixed microwave users to other bands and this furnishes precedent for negotiation between license holders.

**F. For Unlicensed Devices, The Power Limits Proposed By The Commission Are Adequate, Devices Should Be Required To Monitor The Spectrum Before Transmitting, Mobiles Should Be Under Control Of Base Stations Or Have Thresholds Set To Prevent Interference, Short Term Relocation Of Fixed Microwave Users Is Unnecessary And An Industry Committee May Be Appropriate.**

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As set out in Exhibits B and C, ISCDMA operates far under the Commission's proposed power limits, monitors spectrum before transmitting; and subscriber terminals can either be controlled by the base station through the paging channel or, alternatively, thresholds can be set in the subscriber terminal which prevent interference to fixed microwave. Indeed, ISCDMA is the ideal technology for use in the proposed unlicensed frequency band. Not only can the technology dynamically adjust to avoid interference to fixed microwave transmissions, but CTP believes it can also be made to adjust to avoid interference to other users of the unlicensed band. As noted in Section 1. E. above, if all or most operators in the unlicensed band chose ISCDMA, utilization of the band would come to be dynamically allocated between operators based on use. As with the licensed PCS bands, no specific allocation of blocks of frequency is necessary.

Regarding relocation of present fixed microwave users of the proposed unlicensed PCS band, ISCDMA has such substantial capacity in co-existence with fixed microwave that CTP believes short term relocation of fixed microwave users in the unlicensed band will be unnecessary. Finally, CTP would not oppose setting up the proposed industry committees but notes that ISCDMA already meets the design criteria on which the Commission proposes the industry committee might work (p. 49 NPRM).

There is one issue that the Commission does not seem to directly address regarding the proposed unlicensed PCS band, the ability of licensed operators to use this band. ISCDMA would allow a licensed operator to use the unlicensed band, dynamically adjusting to the interference in that band, to compliment its operation in the licensed band. This might occur in periods of peak demand of the licensed band, or when a given licensed area has such extensive microwave transmission that PCS capacity in licensed bands is severely limited. CTP feels the FCC should make it clear licensed operators can also access the unlicensed band.

**G. The Commission Should Provide For PCI In Its Technical Standards Relating To 900 MHz PCS.**

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As noted above, in June of 1990, CTP together with BNR developed an approach, later called PCI, which allows CT2 Plus to share frequency with fixed microwave transmission. CT2 Plus is a national PCS standard for Canada on the



frequencies referred to on page 57 of the NPRM. The development of PCI resulted in filing of a joint CTP/BNR patent in October 1990.<sup>6</sup> It also resulted in CTP's application for an experimental license in September 1991 under the name "Easyphone" (attached Exhibit D) and numerous other filings by CTP, BNR and Northern Telecom with the Commission (see attached Exhibits E and F).

Under the PCI approach, control channels are set up in the 930-931 MHz and 940-941 MHz frequencies. Frequencies allocated to fixed microwave in the 930-960 MHz band are used on a secondary basis through frequency sharing. Channel scanning in the fixed microwave frequencies is done at both base station and handset. From this, interference to fixed microwave is identified. Through control channels, handset and base station together determine the best non-interfering channel. The call is then initiated on that channel. (See particularly in this regard pages 5, 18 and 21 of attached Exhibit E, a Fall 1990 presentation by BNR to the Commission regarding PCI, and pages 4 through 8 of attached Exhibit F). As noted above, the same formulae and algorithms as found in Exhibit C for ISCDMA to avoid interference to fixed microwave at 1850-1975 MHz also apply in 930-960 MHz frequencies to avoid PCI interference to fixed microwave.

Were the Commission to provide room for PCI in its PCS ruling, PCS roaming between the U.S. and Canada would be enabled. How this would work is spelled out in attached Exhibits E and F. A handset operating on PCI in the U.S. would also operate on CT2 Plus PCS in Canada.

For this international roaming to be available with Canada, two things are required. First, of course, PCS must be allowed to share frequency on a secondary basis with fixed microwave transmission in the 930-960 MHz band. The use of the formulae and algorithms set out in Exhibit C will guarantee the 930-960 MHz fixed microwave user against PCI interference. Second, channelization, power, antenna siting and other technical requirements for CT2 Plus control channels must be provided for in the 930-931 and 940-941 MHz frequencies. For example, CT2 Plus/PCI requires 100 KHz channels for its control channels, so 100 KHz channels must be provided in the 930-931 and 940-941 MHz frequencies. Subscriber terminal power for PCI is at 100 milliwatts and microcells are involved. Large regional high power transmitters and high antennas at 930-931 and 940-941 MHz must not be allowed to interfere with this low power, localized PCI transmission.

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<sup>6</sup>A copy of the patent application was filed as part of CTP's pioneer's preference application PP-51.

If the Commission does want to promote international cooperation in PCS as it states that it does,<sup>7</sup> CTP would be happy to meet with Commission staff to work out further details of how the 930-931 and 940-941 MHz allocation and rules should be set to allow PCI/CT2 Plus roaming between the U.S. and Canada.

#### **H. Interoperability And Roaming Should Be Encouraged.**

The Commission states it is tentatively proposing not to require intersystem operability among different licensees (p. 53 of the NPRM). CTP thinks that instead a premium should be placed on intersystem interoperability and roaming capability.

We do not have to remind the Commission of the poor experience with cellular radio. With no intersystem roaming capability requirement for cellular radio, the cellular nation became balkanized, and we are still trying to build the needed seamless system. A similar result for PCS should be avoided at all cost.

Three solutions have been suggested: 1) Grant national licenses to single companies which will provide a seamless PCS network across the country; 2) Grant national licenses to coalitions of companies which together agree to provide interoperability and roaming across the country; 3) Grant no national licenses, but encourage local license winners to provide interoperability and roaming across the country.

CTP is against alternative 1) for reasons cited by many commentators. A single nationally licensed company would have too much competitive advantage versus local licensees. Alternatives 2) and 3) are clearly better from a competitive standpoint.

The concern of CTP is that if the Commission, as proposed, does not encourage interoperability and roaming capability, it will be driven to option 1) above (single company with national license) in order to avoid balkanization of PCS. In other words, if the Commission chooses not to push interoperability and roaming capability, CTP fears that the very lack of interoperability and roaming will be used as a justification for grant of national licenses to single companies. Adopting alternatives 2) and/or 3) solves the competitive problem regarding single company national licenses while achieving the interoperability and roaming capability goals. That options 2) and/or 3) would work can be seen by the interoperability/roaming coalition CTP is building with PCS companies across the country. Already it will be seen companies are grouping around certain

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<sup>7</sup>See, e.g., p. 7 NPRM

technologies such as narrow channel CDMA. De facto standards are in effect starting to be created. This will allow a subscriber in one city to use his/her PCS handset in band in another city. In band means that in each city a band will be set aside for use of the same technology in roaming mode. Creation of such coalitions around de facto standards should be encouraged by the Commission by setting aside a reserved spectrum for at least the first and perhaps first two or three national coalitions that are created. The reserved spectrum should be 10 to 20 MHz.

**I. The Commission Should Encourage Devices With Low RF Radiation.**

ISCDMA subscriber terminals operate at an average 10 milliwatts (see discussion page 53 of NPRM). PCI operates at 100 milliwatts. This low power, and the consequent low level of radiation, is an important advantage of ISCDMA and PCI (see pages 19 and 20 of Exhibit C).

**J. The Commission Should Adopt Its Proposal For 80 MHz Frequency Pairing.**

While, as noted above, CTP feels that requiring specific frequencies blocks unduly restricts the utility of more advanced PCS technology, the 80 MHz offset proposed by the Commission should be adopted (page 16, 17 of NPRM). ISCDMA technology has been created to comply with 80 MHz offsets (see Exhibits B and C).

**3. LICENSING AND REGULATORY MATTERS - THE LICENSING/REGULATORY PROCESS SHOULD ENCOURAGE PARTICIPATION OF THE DEVELOPERS OF PCS, SUCH AS CTP, IN EVENTUAL PCS OPERATION.**

CTP is greatly concerned about the way the PCS licensing process is developing, particularly the recent award of a mere three pioneer's preferences for PCS. The ISCDMA and PCI technology CTP has developed for frequency sharing is, we feel, the best in the world. CTP's earliest technology, PCI, allows PCS roaming between the U.S. and Canada, meeting important international cooperation goals of the Commission. Now with ISCDMA (Exhibits B and C) CTP believes it has further advanced PCS frequency sharing technology at 1850 -1975 MHz. ISCDMA exceeds all rival technologies in terms of capacity, quality, low cost and dynamic flexibility to adjust to fixed microwave interference.

Let us assume for the moment that CTP is correct, that it has invented the best PCS technology in the world for frequency sharing with fixed microwave. The question then is what inducement will exist under the Commission's proposed PCS rules for CTP

to continue to develop its technology, and to provide its benefits to the U.S. consumer and the PCS industry in general? Many other entrepreneurial PCS companies with which CTP deals are asking the same thing. If operating licenses are going to be awarded by unrestricted lottery, or by expensive auction in which smaller companies can't reasonably be expected to participate, and if further pioneer's preferences aren't to be given, why should the smaller PCS developer do any further development work on PCS technology? We are not major manufacturing companies which can afford the risk of developing technology where payoff is unclear. Small, entrepreneurial PCS technology and service developers need at least some promise that their development, if proven successful, will offer possibility of eventual license.

At this juncture it seems to us a primary Commission goal should be to continue to encourage development of all promising PCS technologies. PCS is still a very long way from proving out the technology which will best allow utilization of the 1850-1975 MHz frequency band. It may be, as CTP believes, that CTP's technology, ISCDMA, will turn out in the long run to be a far better technology for PCS than, for example, the APC FAST system. Or it may be that some other new technology will come forward. It is simply too early to know. It must be emphasized that despite award of pioneer's preferences no company has to date demonstrated a full working system in frequency sharing with fixed microwave at 1850-1975 MHz.

CTP feels that this filing is not an appropriate place to argue more pioneer's preferences should have been given. But having tentatively rejected further pioneer's preferences for PCS, the Commission should carefully craft its licensing/regulations to provide continuing encouragement to the entrepreneurial PCS developer. To not do so will risk the loss of development of many excellent PCS technologies.

There are a number of possible approaches to providing continued encouragement to entrepreneurial PCS technology and service developers:

- Whether a lottery or auction process is instituted for PCS licensing, pre-qualification could be required; and those, like CTP, which have been in the forefront of PCS development, could be automatically pre-qualified. The possibility of having an initial "public interest" determination in connection with auctions is mentioned on page 36 of the NPRM relating to English experience. Germany has recently successfully used pre-qualification followed by lottery in awarding regional SMR licenses. The alternative we are here proposing is to provide continued encouragement to PCS development by first requiring pre-qualification as in the U.K. and German approach. A technical, financial and business capability showing would be required of all applicants before lottery or auction. Then there would be automatic pre-qualification of "PCS developers." The Commission would confer PCS developer status for this purpose on all of

the 57 companies on the "short list" for pioneer's preference, plus any other companies which the Commission felt had made important contribution to PCS development.

- If the Commission does not want to engage in a pre-qualification process, another approach would be to give PCS developers a privileged position in the lottery or auction. For example, in a lottery the PCS developer could be given more chances. This could be accomplished by restricting non-PCS developers from entering lotteries which together covered more than three licenses while PCS developers would be allowed to enter all lotteries (i.e., the lottery for each license region in the U.S.). If instead of a lottery process an auction process is adopted, the special position of PCS developers could be recognized by allowing them to take any license region by meeting the auction price established in the initial auction (i.e., meeting the lowest price which gains a license). Alternatively, it could be provided that PCS developers, and PCS developers alone, will be able to pay for the auction price out of future cash flows (others would be required to pay "up front"). The former alternative would work by first having the auction and then having a second auction wherein PCS developers would have the right to overbid those initially bidding (i.e., non-PCS developers) for license regions the PCS developers wanted.
- As a third possible approach to encouraging continued PCS development, have a special award of licenses to PCS developers just prior to the general award of PCS licenses. This would be done by setting aside one piece of PCS frequency for PCS developers. CTP suggested above that such a set aside be done for coalitions of PCS companies that promised to provide intersystem in band interoperability and roaming. Here CTP suggests the same thing be done for PCS developers. In this connection, CTP agrees completely with the comments of Tele/Logic, Inc. in support of creation of a "PCS Developer Block" (pages 13-15 of the Comments of Tele/Logic, Inc. to the NPRM).

The process would be similar to that used for award of the initial three tentative pioneer's preferences. We note in this connection that the Commission has recognized that it has considerable flexibility in its application of the rules relating to pioneer's preferences where there is "good cause" to exercise this flexibility (p. 58 of NPRM). CTP suggests that good cause should be found in the continuing encouragement of development of PCS technologies and services. Indeed, encouragement of technology and service development is the precise reason the pioneer's preference rules were promulgated. Thus award of a special series of licenses to PCS developers just prior to general license award would be

directly in line in the intent of the pioneer's preference rules. Also, as noted above, in this case it is especially needed as many good technologies are still in development, and the current three tentative pioneer's preferences are being awarded much earlier in the development process than, for example, the tentative award made to VITA LEOSAT.

**4. SPECIFIC COMMENTS ON LICENSING AND REGULATORY MATTERS - THE LICENSING/REGULATORY PROCESS SHOULD BE DESIGNED TO MEET THE GOALS OF UNIVERSALITY, SPEED OF DEPLOYMENT, DIVERSITY OF SERVICE AND COMPETITIVE DELIVERY.**

Following are CTP's comments on many of the Commission's specific licensing/regulatory questions:

**A. To Balance The Goals Of Universality And Competitive Delivery No More Than Three Licenses Should Be Awarded For A License Area Unless Intrasystem Interoperability Is Provided By All Operators.**

The Commission is familiar with the CT2 experience in England. Without intrasystem interoperability the viability of competitors (i.e., the competitive delivery goal) and the goal of universality are put in jeopardy. At present in England, only one of the original four CT2 licensees appears to be going ahead with the service. A primary reason for this has been lack of interoperability (i.e., CAI).

CTP recommends the Commission encourage interoperability as a goal for PCS licenses. The reason is that intrasystem interoperability best meets the Commission's goal of universality. Universality of service would not occur, or occur only in a hodge-podge manner, if PCS operators used a variety of differing technologies preventing use of handsets on all systems in the geography. If intrasystem interoperability is not required by the Commission, CTP feels that the goal of competitive delivery (i.e., viable competitors) would require fewer rather than more licensees in a license region. Specifically, CTP feels the number of license holders should be limited to no more than three absent intrasystem interoperability. If, on the other hand, interoperability occurs, four or even more licenses could be granted for a market.

The reason for this conclusion is coverage. The CT2 experience in England, studies CTP has conducted and other studies to which CTP has access, demonstrate that for PCS to be viable in the public base station mode (i.e., Telepoint) subscribers must be assured of being able to call and receive calls in their areas of daily travel and desired PCS usage. Without intrasystem

interoperability, this requires a very substantial infrastructure capital expenditure from the operator. The operator must provide all needed coverage itself as it can't rely on sharing coverage through interoperability with other operators.

Before making the capital expenditure to provide all needed coverage on its own, the operator must have assurance of market share. This in turn requires that the number of licensees be restricted. In short, if the Commission wants viable competitors and universality of service, it should either promote intrasystem interoperability or restrict number of licensees.

To promote intrasystem interoperability the Commission should retain some frequency initially, perhaps 10 MHz. This should be released to the licensees to be shared among them if they agree to intrasystem interoperability. Otherwise the reserved 10 MHz should be later awarded (say in 5 years) to the operator with the largest number of customers and hence largest need.

CTP also recommends the Commission consider licensing a different number of competitors in compact, urban markets than in more rural markets. Infrastructure capital cost per subscriber will be higher in less compact geographies; and this translates to a need for fewer competitors. Note in this connection that because of the smaller cell size with PCS, the same economics do not apply as have applied for the RSA cellular market. Based on CTP's analysis of infrastructure cost,<sup>8</sup> and assuming a requirement of interoperability, CTP recommends that three or more competitors be licensed in geographies such as New York, but only two for geographies such as Alaska, Montana, or North and South Dakota.

**B. No Specific Channel Blocks Should Be Allocated To Licensees Within The 90 MHz Proposed For Licensed PCS Operation.**

We have already commented on this. ISCDMA allows sharing between licensees based on the relative need for spectrum generated by subscriber demand of each licensee. All licensees basically share all spectrum. To the extent that ISCDMA is not adopted, CTP still feels specific block allocation should not be instituted. The reason is that specific allocation has the danger of being unfair in areas where one channel block is more severely impacted by fixed microwave transmissions than another block. Rather, CTP submits, the Commission should require PCS licensees to negotiate together to come up with a fair allocation of

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<sup>8</sup>CTP has done extensive analysis of infrastructure cost. While ISCDMA offers low infrastructure costs compared to competitive technologies, urban areas are clearly more viable than rural areas.

frequency in their geography, whether through adopting an approach such as ISCDMA allowing sharing of all frequencies, or setting aside channel blocks tailored to specific microwave interference in the particular area. This solution would best meet the Commission's goal of competitive delivery (i.e., fairest competition), plus probably also best meeting the goals of universality and diversity of service (both of which will benefit from a "level playing field" and certain cooperation among licensees in a geography).

**C. The Four Goals Of The Commission Do Not Require The Set Aside Of A Separate Unlicensed Band.**

CTP has previously commented that licensed operators should be allowed to use the unlicensed band (if the Commission creates such a band) and that ISCDMA would allow sharing of the unlicensed band without allocation of separate frequency blocks. However, CTP believes that set aside of a separate unlicensed band is unnecessary and may undermine the goals of universality and diversity of service.

As the Commission is aware, one of the most attractive capabilities of PCS is its ability to serve the subscriber in home, office and mobile environment through the same handset and ultimately with the same telephone number. The subscriber advantages from this lie not only in convenience but also in lower cost (i.e., shared infrastructure cost). What is true of voice is also true of data. The best solution for the subscriber in terms of low cost and greatest convenience is the most integrated solution - a single, integrated PCS network supporting home, office and mobile use for both data and voice as needed and where needed by the subscriber. The growth and capabilities of the present integrated land line telephone network validates the attractiveness of providing such an integrated approach.

What concerns CTP is that a set aside for unlicensed PCS services may encourage development of separate, more expensive PCS data services and separate stand alone PCS services for office use (i.e., wireless PCS and Centrex), and that these will not be integrated with common carrier PCS services for maximum subscriber advantage. There will be far less impetus for a data company or a PBX manufacturer to coordinate their technology with the licensed PCS operators in the area for maximum utility and cost advantage if they can obtain separate frequency (unlicensed) for PCS data and office services. A negative impact would clearly occur on universality of service offering. But less obviously it will negatively impact diversity of service offerings. Greatest diversity of services offerings occurs from being able to offer services at least cost, and least cost comes from being able as far as possible to share a single infrastructure cost for all PCS voice and data services. In other words, CTP submits that for maximum



diversity of service offerings, PCS should be provided through coordinated offerings.

CTP's specific recommendation regarding services the Commission contemplates for the unlicensed bands is that licensed operators provide the necessary coordination of these services and that all services be provided under PCS operator operating licenses. For data services, this would encourage data companies to work with PCS voice operators to create integrated, low cost solutions of maximum subscriber benefit. For office PCS services, this would encourage PBX and Centrex manufacturers to work with PCS operators to ensure that common handsets can indeed be used in home, office and mobile environment.

Note in this connection that the Commission's PCS rules must prevent the PCS licensee from "holding up" data companies and PBX and Centrex manufacturers and users. The PCS license should forbid the licensee from charging the data company and PBX/Centrex manufacturer for use of the licensed frequency, and should grant an automatic sub-license to PBX/Centrex manufacturers and users. The data company and PBX/Centrex manufacturer will thus be granted free access to the frequency but be forced to interoperability with PCS operators.<sup>9</sup>

**D. As ISCDMA Will Not Require Relocation Of Fixed Microwave Users In the Near Term, No Specific Rules Regarding Negotiation Of Relocation Should be Adopted.**

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Because of its capacity and unduplicated ability to share spectrum with fixed microwave users, ISCDMA allows PCS to be introduced without near term relocation of fixed microwave users. Indeed, one of the benefits of ISCDMA is that it could even share the 1850-1975 MHz band on a secondary basis as it can adjust dynamically to introduction of new fixed microwave users and changes of present microwave paths.

As a result, CTP recommends against setting hard and fast rules for negotiation of fixed microwave user relocation. Instead, the market should be

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<sup>9</sup>One of the advantages of promoting interoperability among PCS licensees is that this allows sublicensing of data company and PBX/Centrex manufacturers and general interoperability as here proposed. Interoperability among PCS licensees sets up a de facto standard for PCS against which PBXes and Centrexes can be manufactured, and this in turn increases the utility of PCS PBXes and Centrexes to the extent the same handsets can be used in home, office and mobile environments.